Workplace Quality News

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RCF Health Issue Chronology

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This article provides an abbreviated chronology of relevant events in the history of the RCF industry with particular emphasis on the Unifrax Corporation and its proactive approach to the RCF health issue.

1942

RCF was invented by J.C. ("Charlie") McMullen, a research scientist at the Carborundum Company (forerunner to Unifrax). The first Carborundum-sponsored health study completed in 1953 at the Mellon Institute, RCF was categorized as "nuisance dust."

1984

A single hamster used in an inhalation study of RCF at *Los Alamos National Laboratory* (LANL) developed a mesothelial tumor. Carborundum promptly notified the Environmental Protection Agency (EPA) of this single incident and in the tradition of routine, proactive communication of RCF data and findings, customers were advised that exposure to RCF could be a potential hazard to humans.

1987

The International Agency for Research on Cancer (IARC) classified RCF along with other man-made vitreous fibers in category 2B "possibly carcinogenic in humans," based on earlier animal studies. This classification was later reaffirmed for RCF in 2002.

TIMA, now replaced by the *Refractory Ceramic Fibers Coalition* (RCFC), sponsored a medical surveillance program and a parallel Carborundum study initiated at the University of Cincinnati. "ECFIA," representing the High Temperature Insulation Wool Industry in Europe, started a parallel epidemiological study of workers in European plants.

1988

Due to conflicting results obtained in the LANL and previous animal studies of RCF, it was decided that a comprehensive inhalation study was necessary. A *maximum tolerated dose* (MTD) study on hamsters and rats was initiated at the *Research and Consulting Company* (RCC) in Geneva, Switzerland.

1989

A multiple-dose rat inhalation study was also initiated at RCC.

The first study of the health of European RCF workers was published. The study concluded that exposure to RCF is associated with irritant symptoms similar to those seen in other exposure to man-made mineral fibers and that cumulative exposure to respirable RCF may cause airway obstruction by promoting the effects of cigarette smoke.

1990

The RCC hamster study was completed, the results showed mesothelioma and pulmonary fibrosis in the RCF-exposed group. RCF exposure levels were in the range of 200 f/cc to 400 f/cc.

1991

The U.S. *Environmental Protection Agency* (EPA) initiated an accelerated review of RCF based upon data submitted by RCF producers under section 8 (e) of the *Toxic Substances Control Act* (TSCA).

The industry adopted a 1 f/cc recommended exposure guideline. Individual *product stewardship programs* (PSP) were integrated and aligned at various RCF producers.

1992

A study of stack emissions and ambient concentrations of RCF in the vicinity of plants and landfills was completed. The study was sponsored by TIMA and done cooperatively with U.S. EPA. It concluded that total annual RCF emissions are low as are fiber concentrations.

The *Refractory Ceramic Fibers Coalition* (RCFC) was formed as successor to TIMA for RCF producers. RCFC focuses on health, safety, and environmental quality issues related to RCF. See http://www.rcfc.net.

1993

RCFC signed a Consent Agreement with U.S. EPA initiating a five-year (1993-1998) program to develop additional monitoring data on occupational exposures at RCF production and processing facilities—including facilities operated by customers. EPA stated (56 FR 92, May 14, 1993) "EPA is particularly encouraged by the commitment of RCFC to monitor workplace exposures to RCFs and to look for ways to reduce exposures. EPA believes that such a program is a significant step towards the reduction in the risk of RCFs." Semiannual reports are submitted to EPA for the duration of the program.

1994

The *National Toxicology Program* (NTP) listed RCF as a substance reasonably anticipated to be a human carcinogen in the Seventh Annual Report on Carcinogens based on sufficient evidence of carcinogenicity in animals. Also in 1994, the University of Cincinnati researchers published interim results of the U.S. epidemiology study. Results indicated

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that some pleural changes (principally pleural plaques — non-disease related markers of exposure) were associated with time since the first RCF production job.

From 1994 to 1998, RCFC (subsequently Unifrax) sponsored a series of studies by personnel from the University of Rochester and State University of New York at Buffalo on the deposition and clearance of RCF from the lungs of hamsters, rats, and humans. These studies culminated in a comprehensive dosimetry model for RCF in humans. These studies also show that the RCC RCF experiments resulted in overload.

1995

A series of papers describing the results of the RCC studies in rats and hamsters were published in *Inhalation Toxicology*. The results indicated that hamsters exposed to RCF developed fibrosis and mesothelioma and that rats exposed to RCF developed fibrosis and lung cancer.

1996

BP sold the Carborundum Company in 1996. The fiber operations were sold to an investor group and renamed Unifrax Corporation. Also in 1996, *Insulfrax®* was introduced as a high temperature, but less biopersistent fiber. This fiber was the first product in a new generation of the *alkaline earth silicate* (AES) wools.

1996

Everest Consulting Associates and Clayton Environmental completed a comparative study of RCF aerosols used in RCC experiments and those found in the workplace. The study concluded that fiber size distributions were similar, but that particle to fiber ratio was much greater for RCC aerosol. The analysis provided potentially important insight regarding possible source of overload in RCC experiments.

1997

The *American Conference of Governmental Industrial Hygienists* (ACGIH) classified RCF as A2 (Suspected Human Carcinogen) and continued process of establishing *threshold limit value* (TLV) for RCF. TLV subsequently established at 0.2 f/cc. See *Workplace Quality News* No. 14.

Industry REG for RCF lowered to 0.5 f/cc on the basis of prudence and feasibility.

1998

Isofrax® was introduced as the first of the second-generation high temperature, low biopersistence AES wools.

Sciences International Incorporated (SII) completes risk analysis of occupational exposure to RCF based on results of RCC studies and dosimetry studies. Study concludes that excess risk associated with working lifetime exposure to RCF at 1 f/cc ranges from 3.7 x 10^{-5} to 1.5 x 10^{-4}. These risks do not address possible confounding effects of coexposure to particles. See *Workplace Quality News* No. 11.

University of Cincinnati researchers publish additional results of epidemiological studies. Results showed that in men there was a statistically significant decrease in *forced vital capacity* (FVC) for current and past smokers. For *forced expiratory volume in one second* (FEV_1) the decrease was significant only for current smokers. The decrease in lung function for men did not persist after the initial worker evaluation.

2000

RCFC sued ACGIH claiming that there was no adequate basis for setting TLV for RCF. The suit subsequently settled after ACGIH issued a statement clarifying the meaning of TLVs.

2001

The *Institute of Medicine* (IOM) study of morbidity of European RCF workers was published. The study concluded that the prevalence of respiratory symptoms were low. Spirometry results indicated that FEV_1 and FVC were inversely related to exposure to fibers in current smokers only. No interstitial fibrosis was found.

2002

RCFC, with endorsement of the *Occupational Safety and Health Administration* (OSHA) launched PSP 2002, a five-year cooperative program that further expands the industry's successful PSP. Summary reports are provided to OSHA annually. See *Workplace Quality News* No. 16.

2002

Mortality data from the ongoing epidemiological study was analyzed using risk analysis methods. The published study finds the best estimate of incremental lung cancer risk is zero and concluded that available data are incompatible with hypothesis that RCF is as potent as amphibole asbestos.

2002

The University of Cincinnati researchers published an additional paper summarizing analysis of radiographic changes; RCF exposure still associated with pleural plaques, but no interstitial fibrosis was found.

2003

The University of Cincinnati researchers published an interim findings of the mortality study of U.S. RCF workers. *Standard mortality ratios* (SMRs) showed that there was no excess mortality related to all deaths, all cancers, malignancies, or diseases of the respiratory system, including mesothelioma.

RCF CAS Definition

By Russ Person, Sr. Product Safety Specialist

In *Workplace Quality News* Number 17, we presented the Chemical Abstracts Service (CAS) definitions for the newly developed alkaline earth silicate fibers. For further reference, this article discusses the CAS definition of Refractory Ceramic Fiber (RCF).

The Chemical Abstracts Service (CAS) Registry is the largest substance identification system in existence. When a chemical substance is newly encountered in the literature processed by CAS, identifying information is added to the Registry and assigned a unique CAS Registry Number. The Registry now contains records for more than 41 million substances.

CAS Registry Numbers are used in reference works, databases, and regulatory compliance documents by many organizations around the world to identify substances without the ambiguity of chemical nomenclature.

The Chemical Abstracts Service (CAS) number and definition for "Refractories, fibers, aluminosilicate" (RCF) is as follows:

CAS # 142844-00-6

Amorphous man-made fibers produced from the melting and blowing or spinning of calcined kaolin clay or a combination of alumina (Al203) and silica (SiO2). Oxides such as zirconia, ferric oxide, titanium oxide, magnesium oxide, calcium oxide, and alkalies may also be added. Approximate percentages (by weight) of components follow: alumina, 20-80%; silica, 20-80%; and other oxides in lesser amounts.

Low Airborne Fiber Exposure Potential During FyreWrap® Installation

By Sara Brewer, Unifrax Corporation, Group Product Manager
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In recent years, flexible blanket duct wrap systems like Unifrax's FyreWrap® Duct Insulation have been introduced to provide fire-rated enclosures around kitchen exhaust grease ducts, chemical fume exhaust ducts, smoke extraction ducts, stairwell pressurization ducts, and other ventilation air ducts. The conventional method of fire protecting these ducts was to construct a gypsum board shaft around the duct offset 6"-18" from the duct surface to create a heat dissipating airspace. This method of protection is labor intensive and requires significant space to accommodate the required clearance distance.

Meets Code Requirements

Extensive fire testing at independent laboratories to nationally recognized test standards such as UL1978, AC101, and ASTM E-119 verify these flexible blanket duct wrap systems capability to provide equivalent fire protection to traditional shaft enclosures. Design listings issued by labs such as Omega Point Laboratories, Underwriters Laboratories and others, confirm compliance with the building and mechanical codes. National Mechanical Codes (including the International Mechanical Code) now recognize flexible blanket duct wrap systems as an alternate or "exception" to the gypsum board method of protection.

Health and Safety Aspects

Flexible blanket duct wrap materials have a number of health and safety aspects. Market demand is trending toward the use of soluble fiber chemistry blankets for the flexible blanket duct wrap systems. These blankets have a calcia-magnesia-silica chemically and specifically designed to enhance biosolubility. This is advantageous since many of the duct wrap installations are in public spaces (restaurants, exit stairwells, etc.). FyreWrap® Duct Insulation incorporates Insulfrax® Thermal Insulation, for its standard product offering. It provides excellent fire protection insulation in a non-combustible blanket product form. Another safety aspect of the product is the use of a metalized fiberglass reinforced scrim to completely encapsulate the core insulation blanket. This scrim minimizes fiber exposure and provides additional handling strength as well as protection from grease, moisture absorption, and tearing. All components are UL Classified.

Features and Benefits

Flexible blanket duct wrap systems provide numerous features that result in significant space and labor savings, issues important to industry professionals such as architects, specification writers, and installers.

These following features can directly impact their ability to design and construct safe and cost-effective buildings:

- ✓ Zero clearance to combustibles at all locations on the duct wrap
- ✓ Two-hour fire endurance rating
- ✓ Flexible, lightweight blanket is easy to handle
- ✓ Thin systems conform to complex configurations, limited spaces
- ✓ Soluble fiber blanket chemistry

Installation and Control of Airborne Fiber

Flexible blanket duct wrap systems are installed directly on to the duct surface, typically with a 3"-4" overlap of all material joints. The duct wrap is supplied in an encapsulated product form minimizing fiber exposure; however, some field cutting is required to create appropriate roll lengths and to fit the blanket to the duct contour in transition areas. The duct wrap is attached to the duct surface with steel banding and/or steel CD insulation pins. To better understand the exposure levels associated with flexible blanket duct wrap systems, measurements were taken at a recent FyreWrap® Duct Insulation installation.

Airborne fiber exposure measurements collected during the installation of FyreWrap® Duct Insulation have shown that fiber exposure potential appears to be relatively low. Sixteen personal airborne fiber samples collected from the breathing zones of workers installing FyreWrap® Duct Insulation around kitchen exhaust (grease) ducts resulted in exposure measurements ranging from 0.01 to 0.09 f/cc (8-hour time weighted average). The samples were collected during installation tasks on five distinct grease duct units over a period of three days.

The installation tasks performed during the wrapping of the grease ducts primarily included impaling and securing the FyreWrap® Duct Insulation over a series of spatially arranged pins welded to the exterior of the grease duct. The actual installation time varied between each distinct unit due to the inherent differences and complexities associated with a specific design and/or layout. To account for installation time differences and periods on non-fiber related work, each personal sample was adjusted to an 8-hour time weighted average (TWA). The average (arithmetic mean) for the sixteen personal samples collected is 0.04 f/cc (8-hour TWA) with a standard deviation of 0.02. The geometric mean is also 0.04 f/cc (8-hour TWA). The fiber exposure measurements ranged from 0.01 to 0.09 f/cc (8-hour TWA).

In the absence of a regulatory guideline or limit, Unifrax suggests that it is generally feasible to control occupational fiber exposure to 1 f/cc or less for the Insulfrax® Thermal Insulation contained within the FyreWrap® Duct Insulation. All samples collected were well below 1 f/cc.

This data indicates that it is unlikely that the use of dust control equipment or respiratory protection would be necessary when handling and installing FyreWrap® Duct Insulation in accordance with Unifrax installation guidelines. Unifrax suggests consulting with a qualified health professional to assist in determining appropriate protective measures for its products as warranted.

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Workplace Quality News Information Guide

NUMBER 20
(Order Code: CHQ-wqn-20
- RCF Health Issue Chronology
- RCF CAS Definition
- Low Airborne Fiber Exposure Potential During FyreWrap® Installation

NUMBER 19
(Order Code: CHQ-wqn-19)
- Innovative Dust Collection Solutions

NUMBER 18
(Order Code: CHQ-wqn-18)
- Advancements in Engineering Control Technology
- New Customer Self-Monitoring Program

NUMBER 17
(Order Code: CHQ-wqn-17)
- 2002 American Industrial Hygiene Conference and Exposition
- Biopersistence Certificates Available on www.unifrax.com
- A New CAS Number for Alkaline Earth Silicate wools

NUMBER 16
(Order Code: CHQ-wqn-16)
- OSHA Signs Letter of Support for RCFC's PSP
- No Change in IARC Carcinogen Classificiation
- Fiber Ranges Chart

Anyone interested in Issues 1-15, call the PSP Hotline at 1-800-322-2293

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